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Apparent Power-Law Behavior of Conductance in Disordered Quasi-One-Dimensional Systems[1] ALEKSANDR RODIN, MICHAEL FOGLER, UCSD — Observation of power-law dependence of conductance on temperature and voltage has been reported for a wide variety of low-dimensional systems(nano-wires, nano-tubes, and conducting polymers). This behavior has been attributed to the Luttinger liquid effects expected in a pure one-dimensional wire. However, the systems studied were neither one-dimensional nor defect-free. Using numerical simulations we show that the power-law behavior can arise from variable-range hopping in an ensemble of non-interacting disordered wires connected in parallel. This power-law behavior holds in restricted ranges of voltage and temperature, typical of experimental situations. Physically, it comes from rare, but highly conducting hopping paths that appear by chance in some members of the ensemble. The power-law exponents and their dependence on system parameters are consistent with the great majority of available empirical data.

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